

AMENDMENTS TO THE SPECIFICATION:

Please replace the title with the following rewritten title:

PIXEL-BASED IMAGE RENDERING SYSTEM

Please replace the disclosure beginning at line 10 of page 1 and spanning to line 17 of page 1 with the following rewritten disclosure:

Ongoing improvements in personal computers allow users to prepare documents of increasing complexity and variety. Printer manufacturers are increasingly challenged to develop printing systems capable of printing high-quality, high-resolution heterogeneous documents. As the term is used herein, heterogeneous documents are documents ~~that~~which include more than one of the following: images, graphics, and text. Ideally, heterogeneous documents printed by printers accurately reproduce what is composed on a high-resolution computer monitor.

Please replace the disclosure beginning at line 18 of page 1 and spanning to line 29 of page 1 with the following rewritten disclosure:

As an example of one of the challenges facing the printing industry, computer monitors are based on a color regime of red, green and blue pixels (RGB), whereas color printers, namely, inkjet printers, are typically based on a color regime of cyan, magenta, yellow and black (CMYK). The RGB color components of computer monitors are combined together in an "additive" way by mixing red, green and blue light rays to form a plurality of different displayable colors. In contrast, the CMYK components of color inks are applied to media in different combinations in a "subtractive" way to form a plurality of printable colors consistent with CMYK ink cartridges typically contained within the inkjet printer. Transforming images from "RGB space" to "CMYK space" necessary for printing the image on an inkjet printer requires the use of color-rendering techniques.

Please replace the disclosure beginning at line 12 of page 2 and spanning to line 20 of page 2 with the following rewritten disclosure:

Prior-art image rendering systems have attempted to address this problem. For example, U.S. Patent numbers 5,327,265 and 5,272,549 attempted to address the aforementioned problem by using a method wherein both text and images are printed separately, but in the same document. These methods include combining inkjet and laser printer components in a printing system in which the printed information is divided into color and text. The color images are printed using the inkjet printer component and the text (or non-color material) is printed by the laser printer component. This approach has the disadvantage of requiring very complex printers in order to print heterogeneous documents.

Please replace the disclosure beginning at line 21 of page 2 and spanning to line 27 of page 2 with the following rewritten disclosure:

U.S. Patent numbers 5,704,021 and 6,040,927 disclose methods of color inkjet printing for use in printing documents having different color object types. Based on the identified color object type, selected color rendering options are used by the color inkjet printer to produce the document. The prior-art systems in the '021 and '927 patents require categorizing areas of a heterogeneous document to be printed, based on the type of objects contained in regions of the document, and then rendering the objects accordingly.

Please replace the heading at line 5 of page 3 with the following rewritten heading:

SUMMARY OF THE INVENTION

Please replace the disclosure beginning at line 6 of page 3 and spanning to line 11 of page 3 with the following rewritten disclosure:

The present invention provides a pixel-based image rendering system and method of processing source image data for instructing an output device in providing an image having a plurality of pixels. Each pixel has a predetermined number of data bits ~~that~~^{which} are processed by coupling image information to each pixel, assessing the image information for each pixel, and rendering each pixel of the image according to the image information coupled to each pixel.

Please replace the disclosure beginning at line 21 of page 4 and spanning to line 6 of page 5 with the following rewritten disclosure:

Figure 1 is a schematic representation of a prior-art printing system 10 used to generate and print documents or images. Printing system 10 includes a computer 12 having a memory allocation block 14, a graphics device interface (GDI) 16, and a print driver 18. The computer 12 is connected to printer 22 or a plurality of printers via a printing network 20. Box 20 is also referred to herein as a network controller or a printing network controller. Printing network 20 is connected to a plurality of printers, represented in Figure 1 by printer 22 and additional printers 23 and 25, which may be selectively connected to computer 12 via controller 20. Alternatively, one or more printers may be operatively connected directly to the print driver 18 of computer 12, as illustrated schematically in Figure 1 by dashed line 27. In the description of the present invention provided below, it will be understood by those skilled in the art that a printer shown connected to a print driver may, alternatively, within the scope of the present invention, be connected via a suitable network or via direct connection.

Please replace the disclosure beginning at line 7 of page 5 and spanning to line 14 of page 5 with the following rewritten disclosure:

Memory allocation block 14 of computer 12 supports application software, such as word processors, spreadsheets, and database rendering systems. Additionally, computer-aided design and imaging software, such as AutoCAD and PhotoShop, respectively, are supported by memory allocation block 14. The various software applications may be used to generate homogeneous or heterogeneous images consisting of a multiplicity of pixels. When the pixels of the homogeneous or heterogeneous images are to be printed, they form an image data stream 24 as they pass through computer 12 in route to printer 22.

Please replace the disclosure beginning at line 11 of page 6 and spanning to line 23 of page 6 with the following rewritten disclosure:

GDI 16 operates on the source image pixels and outputs the pixels as an image data stream 24 to interim data storage block 28 within IRS print driver 19. Blocks 28, 30, and 32 illustrate process steps carried out in IRS print driver 19. Within IRS print driver 19, pixel data, which is temporarily stored in interim storage 28, is coupled to image information, such as information identifying the pixel type, in step 30. Attaching image information may sometimes be referred to herein as 'adding' image information to each pixel. Adding, for the purpose of this invention, means associating or coupling image information to each pixel. The attached image information is associated with one of four different pixel types, as will be described in greater detail below. The modified pixel information 36 is then rendered in block 32. IRS print driver 19 renders images in accordance with the present invention using attached image information, as will be described in below.

Please replace the disclosure beginning at line 1 of page 7 and spanning to line 14 of page 7 with the following rewritten disclosure:

Figure 3(a) is a pictorial representation of a pixel 40, also referred to as a data set or pixel data set, taken from the multiplicity of pixels forming image data stream 24 as shown in Figure 2. Pixel 40 as discussed herein is a single point in a graphic image capable of being displayed on a computer monitor. The number of bits in pixel 40 determines how many variables define the pixel, such as colors, intensities or shades of gray, etc. that can be displayed. In the illustrated embodiment of the invention, a color monitor or display system uses 24 bits (8 bits-red; 8 bits-green; 8 bits-blue) for each pixel 40, making it possible to display 2-to-the-8th power (256) different colors or shades of gray. Each pixel is composed of three segments or bytes; red 42, green 44, and blue 46 (RGB). Each segment of pixel 40 consumes eight bits, shown in Figure 3(a) at 48, or equivalently a byte of memory. Furthermore, pixel 40 has a most significant bit 50 and a least significant bit 52. Pixel 40, when this term is used herein as a data set, may alternatively be called a pixel data set.

Please replace the disclosure beginning at line 4 of page 8 and spanning to line 19 of page 8 with the following rewritten disclosure:

In the image processing system of the present invention, the associating of one or more image information bits 54 with each pixel data set 40 is preferably carried out in IRS print driver 19 (Figure 2). The pixel data sets arriving via image data stream 24 from GDI 16 are stored in a suitable interim data storage memory 28, such as a buffer. The step of coupling or adding image information bits 54 to each pixel data set 40 is preferably carried out in memory 28, wherein suitable software associates the image information with each pixel. The output of the GDI 16 contains the necessary information to display the content of a document, be it text, vector, or bitmap, etc. The information is accessible in the form of commands and in the data structure of the GDI output. The information bits coupled to each pixel in the present invention are derived from the commands and data structure of the GDI output. After image information bits 54 are coupled to each pixel data set 40, the result, termed modified image information 36, provides enhanced pixel data which is used in rendering images to a printer 22, the resultant images closely approaching the source image 34 which appeared on the computer monitor.

Please replace the disclosure beginning at line 23 of page 11 and spanning to line 2 of page 12 with the following rewritten disclosure:

From the detailed description, it will be appreciated that the present invention provides a pixel-based image rendering system having several objects and advantages including but not limited to the following: (1) The quality of the printed images is improved because each pixel of a homogeneous or heterogeneous image is rendered individually according to image information attached to each pixel; (2) The speed at which an image is printed is increased because some selected pixels are not rendered; and (3) heterogeneous images can be printed on relatively simple, inexpensive printers, such as inkjet printers, without being limited by object type.

Please replace the Abstract of the Disclosure on page 17 of the disclosure with the following rewritten Abstract of the Disclosure:

~~The present invention provides a~~ pixel-based image rendering system and ~~a pixel-based image rendering method provides~~ processing of heterogeneous or homogeneous images, wherein each image comprises a multiplicity of pixels. Each pixel of the image has image information attached thereto. Subsequently, each pixel is processed and rendered according to the attached image information. The pixel-based image rendering system improves the quality of the printed heterogeneous or homogeneous images because each pixel of the image is rendered individually according to the attached image information.